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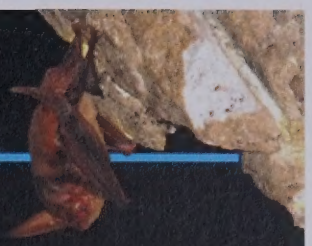

Principles and Practices
of Integrating Science into Land Management

CASE STUDIES

The case studies in this series showcase examples of integrating science into Bureau of Land Management (BLM) decisions and activities. They highlight how science has helped the bureau successfully manage diverse programs across many geographical areas. These examples are not intended as programmatic guidance or policy direction; the application of science will be unique to each circumstance. Rather, they reflect the critical thinking and systematic, transparent process advocated by the BLM's "Principles and Practices of Integrating Science into Land Management: Guidelines." By using that document's recommended Checklist of actions, they demonstrate key principles and practices of effective science integration at work in a variety of fields and resource areas. Individual case studies differ in how they satisfy Checklist objectives, illustrating that the Checklist is intended to be a flexible tool—one that can be customized to meet the unique aspects and needs of different projects. Comprehensive details about individual studies (including related articles and publications) can be found on the BLM's Science in Practice Portal, through the BLM Library and the Alaska Resources Library & Information Services, and through links in these documents.

CHECKLIST

☐ **1. DEFINE THE MANAGEMENT QUESTION(S)**, including related management objectives. All interested parties must clearly understand the management issue(s) if the five guiding principles and practices are to be successfully applied.

☐ **2. FIND** available science relevant to the management question(s). Be systematic, rigorous, and objective, and use a method that is easy for others to follow and that is well-documented.

☐ **3. EVALUATE** the potential relevance and reliability of the science identified in Step 2.

☐ **4. SUMMARIZE** the science, address any conflicting science, and identify any information gaps.

☐ **5. APPLY** your science-based conclusions to the management question(s) to decide the best course of action for achieving management objectives.

☐ **6. ASSESS** how the application of science affected public support, the sustainability and effectiveness of the decision, confidence in the course of action selected, and further learning about the system and the effects of management actions. Plan any future assessments and/or develop and implement a monitoring plan.

Snapshot of Checklist actions from "Principles and Practices of Integrating Science into Land Management: Guidelines." The numbered actions in the case study below track with this list and show how the BLM implemented the principles and practices for integrating science into the BLM's work. Please refer to the full document for details.

CASE STUDY 1: Assessing Cave Restrictions To Ensure Protection from White-Nose Syndrome, New Mexico

1. DEFINE THE MANAGEMENT QUESTION(S).

White-nose syndrome (WNS) is a disease that affects hibernating bats, with mortality rates often reaching as high as 100 percent. The disease was named for the causative fungus (*Pseudogymnoascus destructans* or *Pd*) that infects the skin of the bat's muzzle, ears, and wings. WNS was detected in New York in 2006 and quickly spread across the northeastern United States. In 2010, laboratory tests confirmed the presence of the fungus on a bat collected outside the Selman cave system in northwestern Oklahoma. This represented the first detection of the fungus west of the Mississippi River, elevating the concern for protecting bats and their hibernacula in the West. BLM New Mexico has documented approximately 500 caves on public lands that meet criteria under the Federal Cave Resources

Townsend's big-eared bat, Fort Stanton, New Mexico.

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Protection Act of 1988. Since the fungus that causes WNS was detected in an adjacent state, BLM New Mexico needed to act quickly to attempt to provide a measure of protection for its bat populations. As a result, the BLM needed to answer two key questions:

- *Would closing caves likely provide bats in New Mexico with a measure of protection from WNS?*
- *If so, which caves would need to be closed?*

2. FIND.

BLM New Mexico gathered available science, including technical reports and peer-reviewed journal articles, to evaluate whether cave closures would provide a measure of protection against WNS for bats in New Mexico. The literature documented that WNS had spread from a single cave in New York to numerous sites throughout the Northeast within only 3 years. This transmission rate suggested that the fungus was spread through direct contact, primarily from bat-to-bat (or bat-to-hibernaculum). Another suspected mode of transmission was by humans, where fungal spores could attach to skin, hair, clothing, and equipment and remain viable for extended periods. The discontinuous pattern of spread also suggested that something other than bat-to-bat transmission played a role. No methodology existed for rapidly screening sites for the fungus if visibly infected bats were absent. Reducing transmission through limiting the natural movements of bats would not be feasible. Rather, scientific findings indicated that decontamination procedures, equipment restrictions, and site closures were the currently available options for managing the spread of WNS.

Bat biologist Debbie Buecher conducts WNS surveys in a BLM New Mexico cave.

Wildlife Biologist Marikay Ramsey (in red) prepares for WNS bat surveys.

3. EVALUATE.

There was no conflicting peer-reviewed science regarding the transmission and spread of *Pd*. There was uncertainty, however, about whether humans were responsible for its original appearance in the United States and involved in its continued spread across North America. Evidence suggested that human-assisted movement of *Pd* had played a role in disease spread, including long-distance jumps in *Pd* occurrence exceeding the natural migratory distances of hibernating bats. In addition, laboratory studies suggested that *Pd* was introduced to North America from Europe (no bat species migrate between the continents). Viable fungus had been found to persist in bat guano and on the surfaces of contaminated hibernacula, and spores had been found on equipment removed from a contaminated site. Human-assisted movement of *Pd* was not unexpected, as other pathogens that persist in the environment (e.g., chytrid fungus and *Cryptococcus*) are thought to be transported by humans. Another possibility was natural, accidental, or intentional intercontinental translocation of bats, which has been documented to occur by ship, aircraft, and shipping containers, and is a possible mode of pathogen transmission.

4. SUMMARIZE.

In the decade since *Pd* was first detected in North America, the bat-killing fungus has spread westward approximately 1,900 km (1,180 miles) from the suspected introduction site in New York State. The evidence indicated that the fungus produces large numbers of spores that can persist and remain viable in environments where bats hibernate, and that it can be transmitted from bat to bat and from environment to bat, and may be spread inadvertently by humans. In 2011 the USGS National Wildlife Health Center recommended implementation of standard procedures

Myotis sp. *hibernating in a cave. Photo by Debbie Buecher.*

known as "universal precautions" to reduce disease transmission and spread. When applied to WNS, these procedures include decontamination protocols, gear and equipment restrictions, and limitation of access to sensitive environments.

5. APPLY.

Based on the available science, BLM New Mexico temporarily closed 28 of the 500 documented caves in January of 2011 for a 2-year period. The cave closures occurred only after extensive public involvement, with five public scoping meetings, four additional public presentations, posted Environmental Assessments, a Federal Register Notice, and the posting of information on the BLM's state website. The closures applied to caves having significant bat roosts. The criteria used for determining whether a cave was a biologically important bat roost were based on data from an existing BLM database of significant caves, supplemented by professional judgment and local expert knowledge. The criteria for evaluating the importance of a roost site are now being revised to rely primarily on a quantitative methodology developed by NatureServe for ranking threats to species.

In temporarily closing the caves to recreational caving, BLM New Mexico followed national bureau guidance (Instruction Memorandum (IM) No. 2010-181) for promoting sustainable bat populations and conserving habitat, as well as interagency national and state guidance for management of actions for WNS. The guidance was developed in conjunction with national interagency working groups involving more than 115 partners. BLM New Mexico's actions were also part of implementing the White-Nose Syndrome Interagency Response Plan for New Mexico, which was developed collaboratively by 13 agencies and organizations.

6. ASSESS.

Since the temporary cave closures expired, 26 BLM New Mexico caves have continued to be managed under IM NM-2014-023 as significant, special use areas, and therefore subject to Special Recreation Permits. During the initial closure, research was conducted in BLM New Mexico caves to determine if and how WNS might vary among bat populations in the East and West. Results suggested that eight of nine western bat hibernacula studied have the appropriate temperatures and humidity for the growth and persistence of *Pd*. Two caves were ultimately reopened to the public based on research results indicating that they were not biologically important bat hibernacula and/or did not have the appropriate microclimates to support the growth and survival of *Pd*. BLM New Mexico has permitted more than 1,150 entries into caves since the restrictions, mostly into Fort Stanton Cave for uses such as search and rescue, WNS surveillance, monitoring and research, and activities that facilitate cave management. BLM New Mexico requires that permittees use decontamination protocols.

Although researchers have made significant strides in understanding WNS, managers continue to lack information on how best to control the spread of the disease. Currently, there are no practical treatments for hibernation sites or bats infected with *Pd*/WNS. BLM New Mexico, however, is helping to support research conducted by the University of New Mexico and others on various native fungi and bacteria that could potentially be used as biocontrol agents. The response to this epidemic demonstrates the necessity of ongoing collaboration across a wide range of disciplines, including bat biologists, wildlife managers, veterinary researchers, disease pathologists, medical mycologists, environmental microbiologists, and the caving community.

Some members of the local caving community continue to resist the possibility of human spread of *Pd*. In 2015 a group of recreational cavers requested that the Pecos District Resource Advisory Council (RAC) reconsider the BLM cave restrictions. The New Mexico cavers presented their perspectives on the BLM's cave management, including their doubts about human transmission of *Pd*. BLM New Mexico followed with a presentation of the early science involved in its decision process, the importance of bats, the national WNS management guidance, BLM New Mexico's adaptive management, and the most recent scientific findings related to WNS. The RAC supported the BLM's process and made no recommendations for change. This support was primarily based on BLM New Mexico's reliance on peer-reviewed science to guide its management actions, and the efforts BLM New Mexico has made to safeguard New Mexico's bat populations while still allowing limited access to significant caves.

BLM New Mexico is currently exploring a "low potential human vector" concept for the Fort Stanton – Snowy River Cave National Conservation Area. This concept would allow only the use of caving gear that is restricted to this specific cave and stored onsite, greatly reducing the potential for *Pd* transmission by cavers. BLM New Mexico continues to conduct monitoring through winter WNS surveillance in coordination with federal and state agencies and the caving community and is collectively updating the WNS Interagency Response Plan for New Mexico.

Fort Stanton - Snowy River Cave National Conservation Area.

For more information, contact: **Marikay Ramsey (Wildlife Biologist)**.

Photos by BLM staff unless otherwise noted.

This case study series is sponsored by the BLM's National Science Committee to support science-based decisionmaking throughout the agency.

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